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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

History and Development of Surf Clam Harvesting Gear

PHILLIP S. PARKER

SEATTLE, WA.
October 1971

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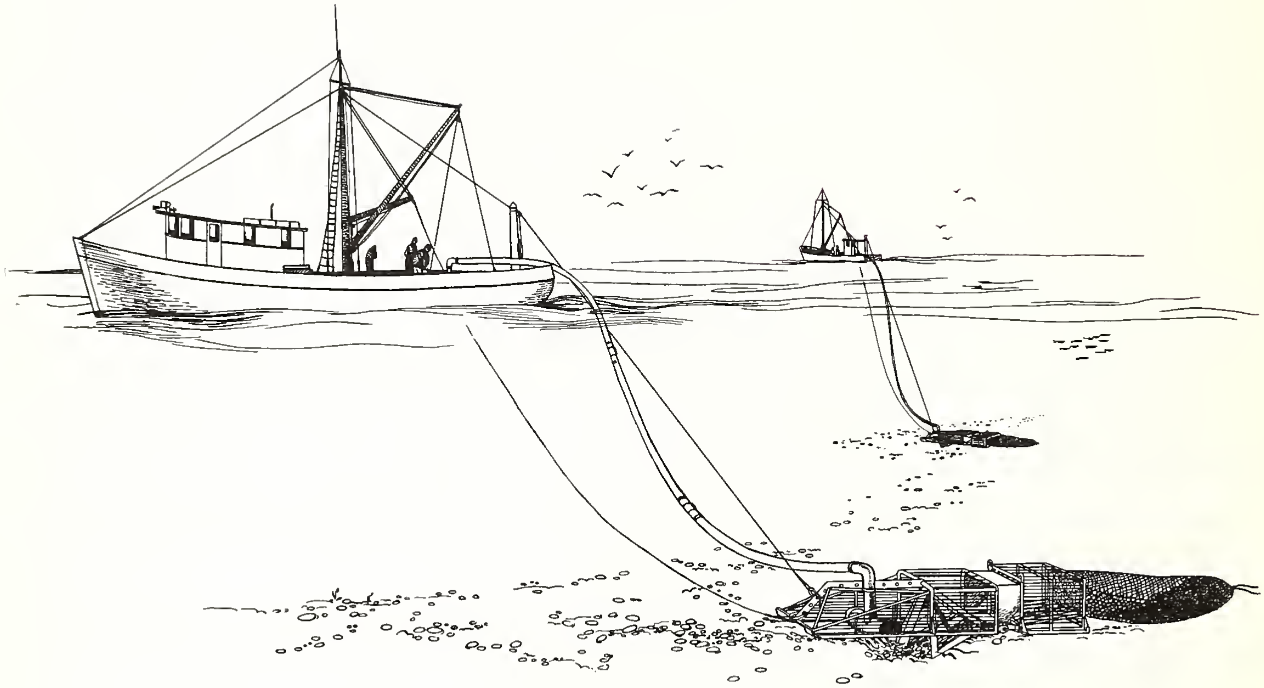

Clam boats dredging for clams with wet (hydraulic) dredges along the east coast of the United States.

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History and Development of Surf Clam Harvesting Gear

By

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ABSTRACT

The development of harvesting gear for surf clams, *Spisula solidissima*, along the eastern coast of the United States is reviewed from early times up to the present.

Early clamming was done by hand using rakes or tongs, while today the industry depends upon large, efficient dredges operating from stable vessels. Little gear development took place prior to World War II; however, since that time, the industry has made rapid strides in the development of harvesting gear. Today this trend is still very much in evidence, with gear constantly being modified for adaptation to newer vessel types.

Most gear development work has been the result of the surf clam industry itself. However, the Federal Government, in cooperation with industry, has developed several pieces of equipment for adaptation to clamming gear.

INTRODUCTION

The history of the development of harvesting gear for surf clams, *Spisula solidissima*, along the eastern coast of the United States has been only touched upon by various authors reporting on this species. However, to date, no comprehensive description of the gear has been written. Prior to World War II, the effort for development of this type of gear was rather limited. Probably this was because the harvesting equipment used at that time was sufficient to maintain an adequate supply of surf clams for both fish bait and the limited market available for human consumption. The World War II years, with the search for good sources of high protein food by both Government and industry, provided the impetus for a tremendous increase in the market demand for surf clams. Due to this demand, rapid development of a variety of surf clam harvesting gear followed. Many kinds of dredges were devised by the industry before the hydraulic jet dredge was developed. Different types of hauling gear and boat sizes were also tried during this period.

Today further radical changes are being made to the so-called "standard" hydraulic jet dredge in an effort to increase its efficiency. Prior to 1963, clam gear research and development were exclusively pursued by the surf clam industry. This group had been responsible for almost all of the changes in the design and modification of the clam harvesting equipment. However, units of the National

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Marine Fisheries Service are now actively cooperating with the surf clam industry and are expending considerable time and effort in the development of new types of clam harvesting gear suitable for use in exploratory surveys and biological studies.

MANUAL COLLECTING METHODS

Hand Collecting

In all probability, the first surf clam harvesting method employed in this country was that practiced by the American Indian. Goode (1887) quotes one of the earliest "tracts" written upon our natural history, Wood's "New England Prospect" (1634), which says that along Nahant [Massachusetts] Beach, the sea "after storms casts up greate store of greate Clammes which the Indians taken out of their shells conny home in baskets," and which also says "Clammes as big as a halfe-penny loof, which are greate dainties amongst the natives."

Another early and simple method of harvesting was employed by farmers along the New Jersey coast, who, after finding large quantities of surf clams washed ashore by severe storms, would shovel them into their wagons to be hauled away for field fertilizer, for hog and poultry feed, or for use as bait. At about the same time (approximately 1878), a new fishery was beginning at Dennisport, Mass., where the surf clam was harvested by means of clam rakes operated from dories which were either hand or sail propelled. This method of dory-hand raking for clams was only used out to about 1½ miles from shore (Fig. 1). The rakes were made of iron with wooden handles and measured from 20 to 27 ft in length; the rake heads had 17 to 25 teeth and cost from $5 to $8 apiece (Fig. 2). Most of the raking was done in water depths of about 8 ft and at ebb tide, although at times the fishermen worked as deep as the length of the rake (approximately 18 ft) and tong handles would permit (Goode, 1887). Potato forks or similar instruments are used to harvest the surf clam in certain areas of Canada.

Rakes

There are two types of rakes used in the commercial fisheries today. These are the common clam rake and the bull rake (Fig. 2). The common rake is similar to a garden rake except that the teeth are larger and sharper. It is equipped with a wire mesh basket or "apron" which holds the catch, and it is generally used in very shallow water. (A modification is used in Maine for gathering Irish moss (Dumont and Sundstrom, 1961).)

The bull rake, used generally in New England, is a large implement with a head between 20 and 30 inches wide (Fig. 2). It has long, curved teeth which are about 9 inches long. Unlike the common hand rake, the bull rake does not have a basket or apron, its handle is usually longer, and it is used in deeper water than the hand rake (Dumont and Sundstrom, 1961).

Like the common rake, the bull rake has numerous modifications. One of these is called the Shinnecock rake. This rake is used only in Maryland. Its long, curved teeth are progressively shorter toward the ends of the rake head (Fig. 2) and are shaped to form a basket in which the clams rest as they are raised from the bottom (Dumont and Sundstrom, 1961).

Tongs

Another implement used during the early days of the industry for gathering surf clams was the hand tong (Fig. 1). Hand tongs are actually a pair of rakes attached to the ends of two long poles which are up to 20 ft in length and are fastened together like a pair of scissors with the fulcrum near the lower end. A basket-like frame is attached to the back side of each rake in order to hold the catch (Dumont and Sundstrom, 1961).

The production potential of rake and tong gear was obviously limited, and before any large expansion could take place in the surf clam industry, development of more efficient harvesting gear was necessary.

POWER COLLECTING METHODS

Scraper-Type Dredges

During the 1920's, scraper-type dredges were developed which could be towed behind power boats. These were usually 18 to 28 inches wide with a knife blade (rather than teeth) located in front of a scoop which sloped upward and backward toward a bag for hold-

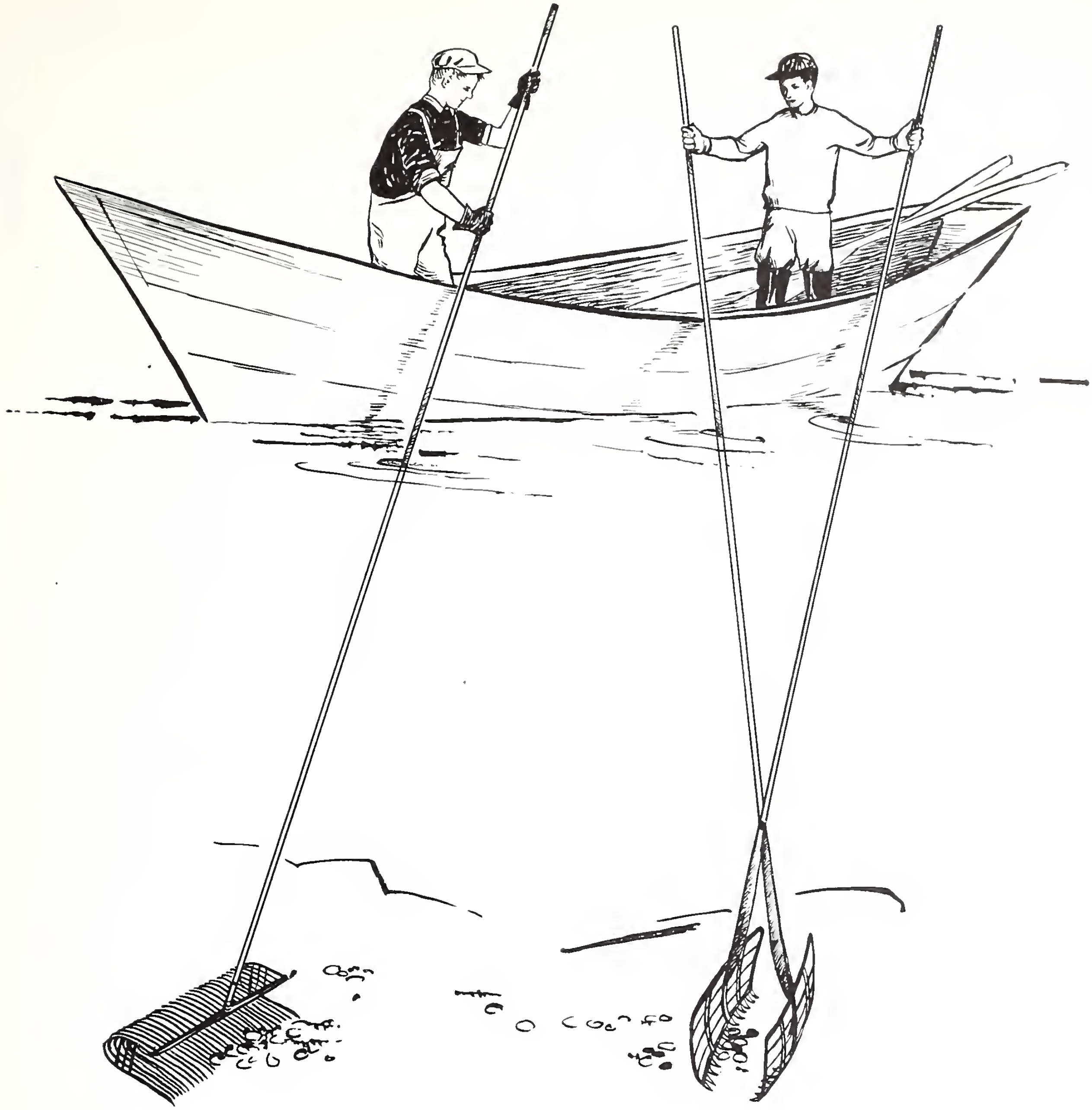

Figure 1.—Raking and tonging for surf clams from a dory in shallow water depths.

ing the catch. The blade scooped into the bottom to a depth of 6.5 to 9 inches. The so-called "Sheepshead Bay" dredge had a more or less straight leading edge to the knife and was adjustable to a desired depth. These dredges were towed by a rope, usually fastened to a special stanchion, and were hauled aboard either by a towing rope or by an additional steel cable attached to the dredge. Both methods used a powered winch (Westman[2]). No further significant changes were made in the dredges for many years. However, the design of some dredges became slightly modified, e.g., the knife was rounded so that the leading edge became an arc.

[2] Westman, J. R. 1946. On the origin, development and status of the surf clam industry, 1943-45. New York Conservation Department, Bureau of Marine Fisheries. Unpublished manuscript, 10 p.

Experiments were made with sleds under the bag in attempts to clear the mud away from the clams more rapidly. In spite of these modifications, the scraper dredges piled up the sand badly, which choked the forward parts of the bag (Westman, see footnote 2). Because of the deficiencies in these dredges, as well as undesirable results from their operation, experiments were conducted in the mid-1940's by the surf clam industry which led to the development of the more efficient hydraulic jet dredge.

Hydraulic Dredges

The hydraulic jet dredge was developed by jetting water directly into the conventional "dry" dredge. The first units built were small but were effective enough to prove their superiority over simple scraper dredges. One of the main advantages of the hydraulic jet dredge was its tremendous reduction in the number of broken clams and damaged meats taken in the catches. By utilization of the water jets, the area that could be dredged during a tow was more than doubled. This made possible the commercial harvesting of clam populations of far less density than was previously feasible. Furthermore, regions of hard bottom which were previously unsuitable for dredging now became productive.

Many experiments using different types and orientation of jets were made. Also, trials using various types and sizes of water pumps, as well as types and sizes of hose, were conducted before the major difficulties were overcome and boats of the commercial fleet were converted to hydraulic jet dredge gear.

The most popular of the early types of dredges was the "Long Island" hydraulic bar clam dredge (Fig. 3) with three jets (Westman, see footnote 2). Water was pumped to these jets by a gasoline-driven pump located aboard the fishing vessel through a 2½-inch canvas fire hose. Special hose was later developed by the rubber industry for this specific purpose. This new hose could withstand internal pressures up to 150 psi even with extensive outside wear from the abrasive action of sand, gravel, etc.

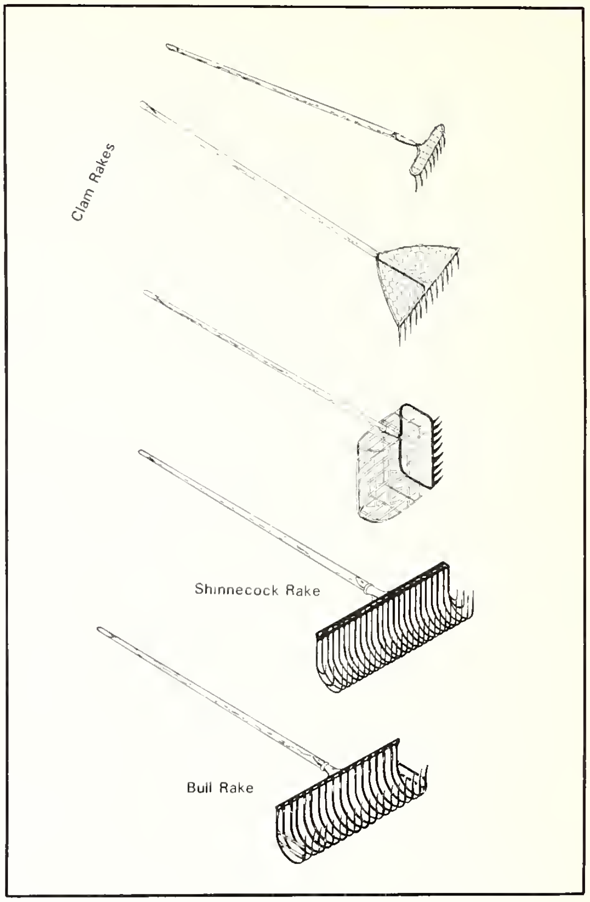

Figure 2.—Types of rakes used for hand collection of surf clams.

The development of the hydraulic jet dredge did not stop here. Although the basic principles remained unchanged, the size and efficiency of the gear were continually increased during the period 1945-65 (Fig. 4). The discovery of large unexploited surf clam beds off the coasts of Maryland and New Jersey (in 1949) resulted in a shifting of the center of the industry from the Long Island area to the coasts of New Jersey and Maryland. Because of the increased availability of clams, the industry was able to expand rapidly and to increase the size and efficiency of the gear used to fish these beds. Dredge sizes have now reached a maximum size of 84 inches in width (Fig. 5).

Correspondingly, the size of water pumps has been increased to maintain the proper pressured flow of water required by these larger dredges. The volume of the pumps has

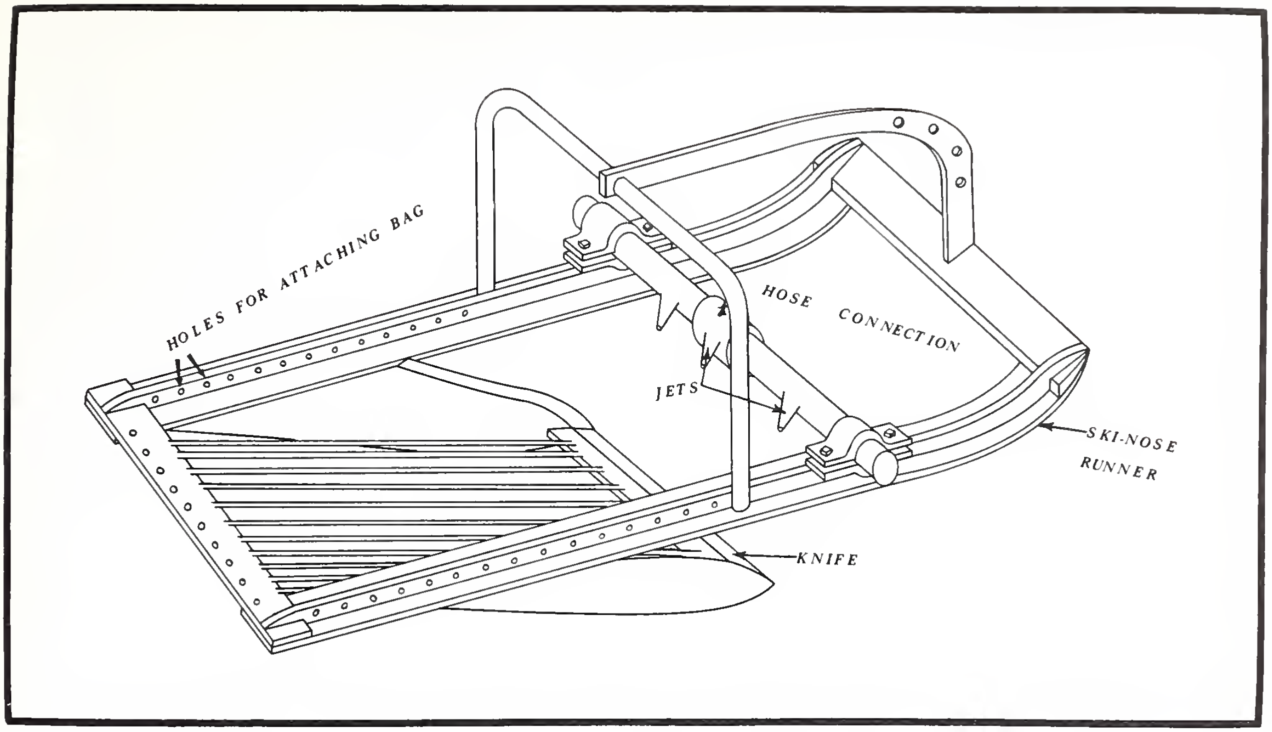

Figure 3.—"Long Island" hydraulic bar clam dredge of the type which became popular with the Long Island clammers. (Drawn by Carl Rich after C. E. Petite and P. W. G. McMullon, Fish. Res. Board Can., Bull. 102, Ottawa, 1955.)

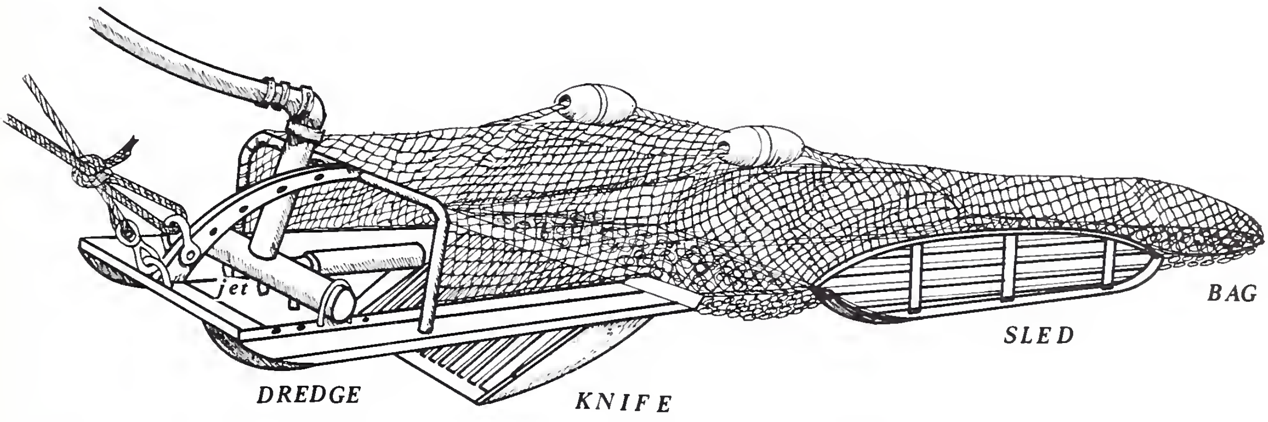

Figure 4.—Early model hydraulic dredge showing sled under bag, one of the early modifications which led to the development of the standard dredge with its after-cage built of steel bars.

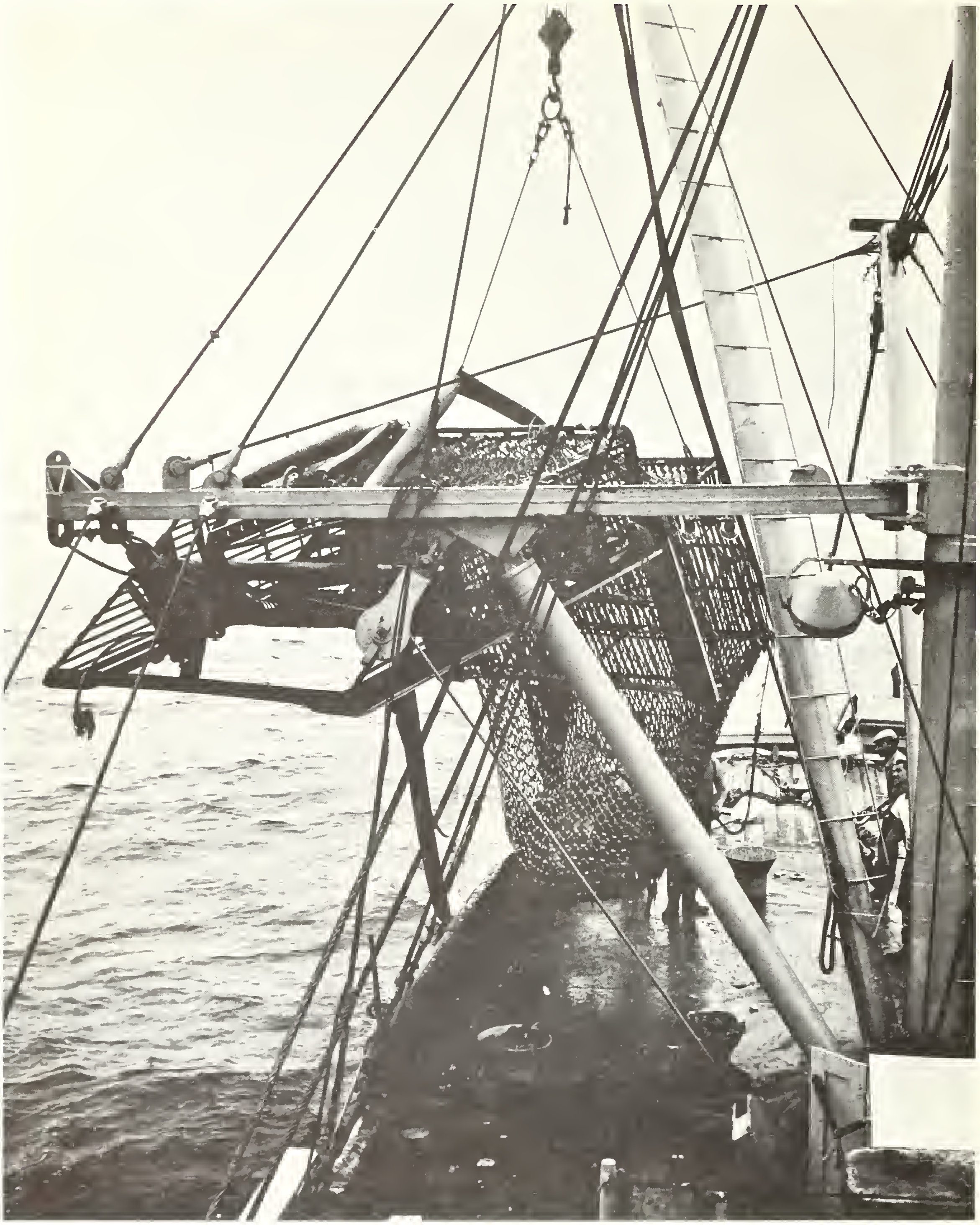

Figure 5.—Photograph of largest hydraulic jet dredge in use today by the surf clam industry. This is an 84-inch dredge used aboard the 136-ft *Gail Borden*. Note size of auxiliary gear and deck equipment required for the operation of this size dredge. Two 6-inch inside diam. water supply hoses are required for the jetting action of this dredge on the bottom.

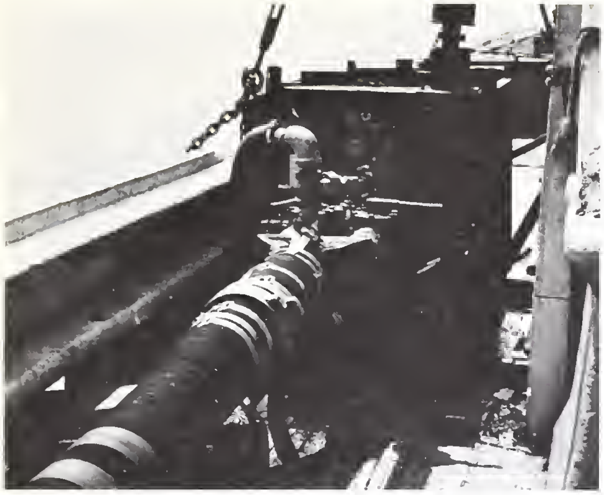

Figure 6.—Gasoline-driven pump on the deck of a clamming vessel.

been increased from a few hundred gallons per minute up to 3,500 gpm. One commercial boat is now using two pumps to supply the required amount of water. Hose size has been increased from 2½- up to 6½-inch inside diameter with some boats doubling-up on the smaller 6-inch hose. As the deck-mounted, gasoline-driven pumps (Fig. 6) became inadequate, they were replaced with diesel-powered units installed below decks. This modification not only increased the available deck space but also improved the operational safety of the vessel.

The dredge most generally used between the late 1950's and the present has been a 40-inch model (Fig. 7). This size dredge is particularly suited to the handling and towing capabilities of most of the commercial vessels in the clam fleet.

Although the size of this dredge is well standardized, many minor modifications are consistently being made in an attempt to improve on its efficiency. These modifications consist mainly of changes in the size and arrangement of the water jets, variations in placement and shape of the jet manifold, changes in the volume and pressure of water supplied to the jets, changes to the shape and contour of the dredge knife, improvements in the attachment of the knife to the dredge, changes of the knife depth setting, variations of towing speed, shape, and slope of the sled floor, construction and attachment of the chain bag, and towing attachment between the dredge and sled. During this period of development, local modifications to the dredges reflected differences in the characteristics of the areas in which they were being used. The shape of the dredge might be slightly different or the type of jet header and arrangement of the jets might be different; also, the type and shape of the knife could vary from area to area. Because of these variations, the physical state of the hydraulic jet dredge can be considered to have been almost constantly changing (Fig. 8).

EXPERIMENTAL GEAR

As the commercial fishing effort increased on the larger clam beds which were located within easy distance from ports and processing plants, these beds have sustained consistent and heavy fishing pressure. As the production rate over these beds leveled out, rich beds located at greater distances from ports and plants have been used. However, the balance maintained between the fishing time to be gained or lost by traveling shorter and longer distances, vs. the production rate(s) of the various fishing grounds, became an important consideration. It now appears that in order to maintain the desired production level, either faster boats or more efficient fishing gear is needed. The latter proposal seems to be the more practical solution. One approach to updating or otherwise improving the gear and fishing method is to adopt methods and gear used by other marine industries for use in the surf clam industry.

Early in 1963, a member of the surf clam industry became interested in the development of an airlift system based upon the principle now used for collecting diamonds off the southern coast of Africa. The principle involved is that of pumping air down to the dredge where the air is directed into the bottom of a large hose extending from the dredge to the boat deck. The air causes the mixed water-air column within the tube to become lighter than the outside water and generates an upward movement of the water within the hose. The water flowing into the bottom of the hose to replace the water which has moved upward

Figure 7.—Classic 40-inch hydraulic jet dredge used by the majority of fishing vessels operating along the coast of New Jersey and Maryland during the late 1950's and up to the present time. Note that the dredge itself is all enclosed except for the bottom and forward section of its top. Loose aprons built out of rings are used to enclose the space between the dredge and sled to prevent loss of clams between the two units. In addition, chain attachments are used between the two units for towing purposes. Attached to the sled is the chain bag built of 3-inch scallop rings and connectors. This dredge is equipped with a straight edge knife. Many dredges use a V-shaped knife that floats on springs and digs into the bottom only after the water to the jets is turned on. In use of spring-mounted blades, the knife settles into a trough which is jetted out by the water. Dredges with this type of blade also use a V-shaped manifold as compared to the straight manifold shown here. The clam jetting hose shown has been built especially for clam jetting and has a 5-inch inside diam.

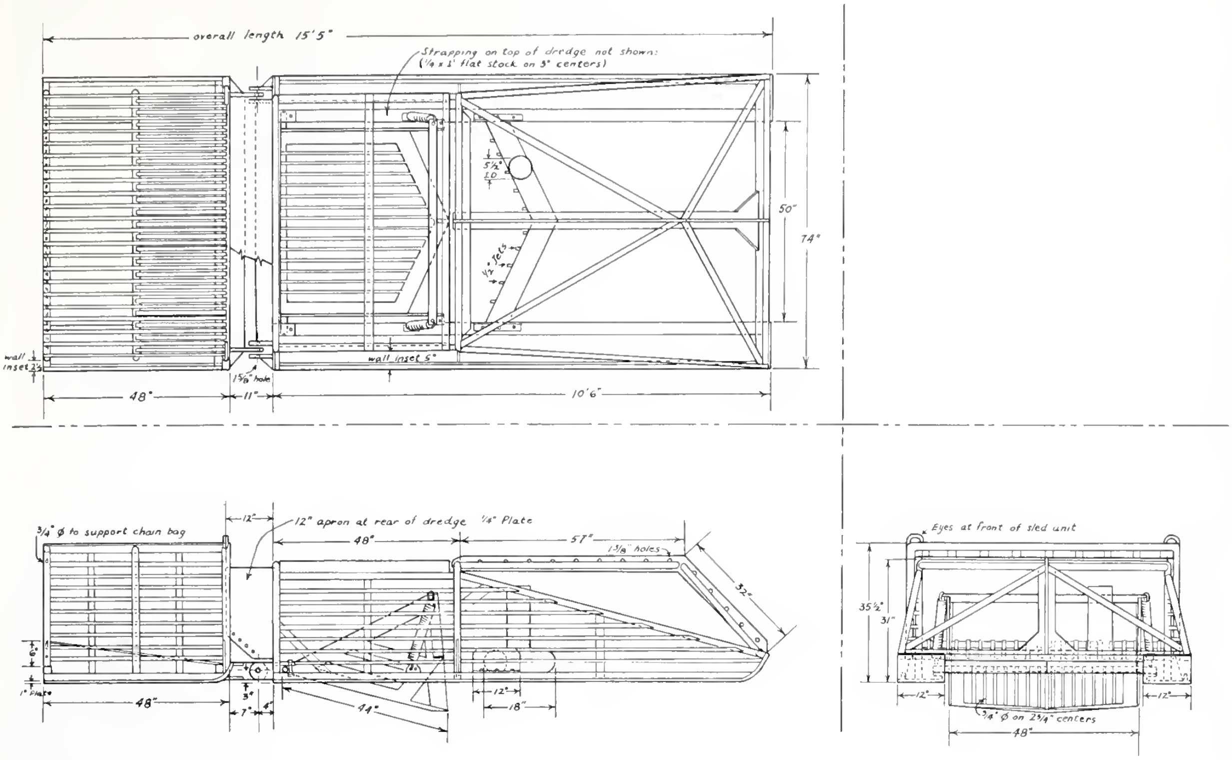

Figure 8.—Drawing of a 48-inch hydraulic clam dredge built for clam survey work aboard the National Marine Fisheries Service research vessels *Delaware* and *Delaware II*.

carries the material dredged from the bottom with it. When fully developed, this system will offer the possibility of continuous dredging without interruption and loss of fishing time for hauling, emptying, and resetting the dredge. In addition, the catch can be constantly monitored, and small beds can be effectively fished.

After preliminary investigation of the feasibility of this method, Snow Canning Company of Pine Point, Maine, began to assemble the needed gear and equipment for building an airlift system on their vessel *Gail Borden*. After building and pretesting component units of the system, a working model was given limited fishing tests during the spring and summer of 1964. Many "bugs" were found, and further effort for modifying the system to correct deficiencies continued. Near the middle of 1965, the redesigned unit was ready for further testing (Figs. 9 and 10). While some minor deficiencies remained, test results were encouraging enough to warrant the development of a complete system for future clam harvesting.

In addition to these developments, submersible pumping systems have been developed to replace the older type vessel-mounted pumping systems used on all the commercial clam boats today. Such a system has an electrically driven submersible pump (of sufficient power and rating) (Fig. 11) mounted on the forward end of the clam dredge. The discharge end of the pump is connected directly to the dredge manifold (Fig. 12). Electrical energy is supplied to the pump from a vessel-mounted generator feeding power through a watertight power cable which is stored on a deck-mounted hydraulically-driven reel. The main advantage

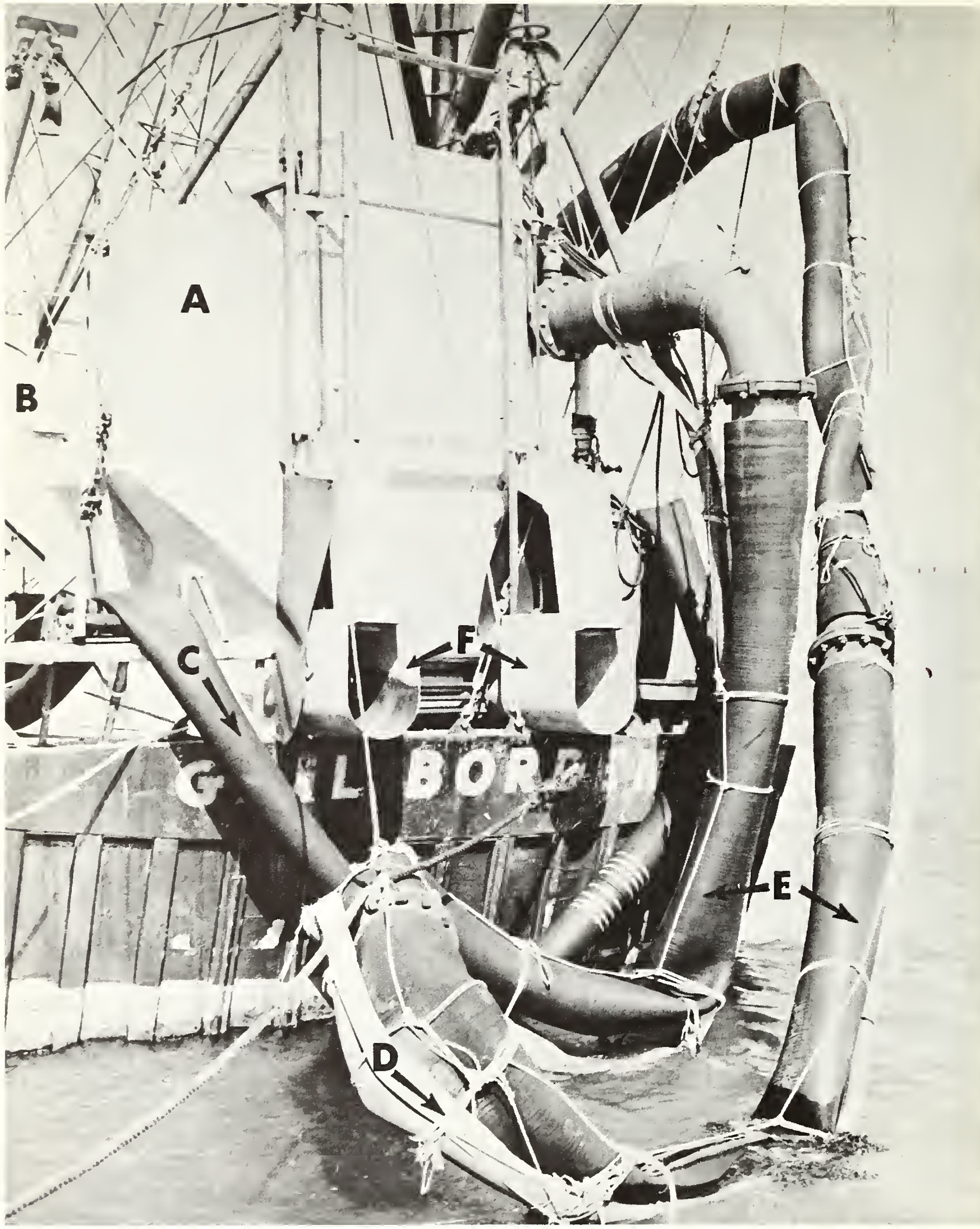

Figure 9.—Constant delivery pump system aboard the *Gail Borden*. A — Separator, where all material transported up discharge hose empties for washing and separation of clams from the rest of the material. B — Escalator, where surf clams enter to be carried up to sorting table or unit. C — Clam jetting water hose. D — Air hose. E — Transporting hose, for carrying material from uptake unit to separator. F — Waste discharge units, through which other material is dumped back overboard.

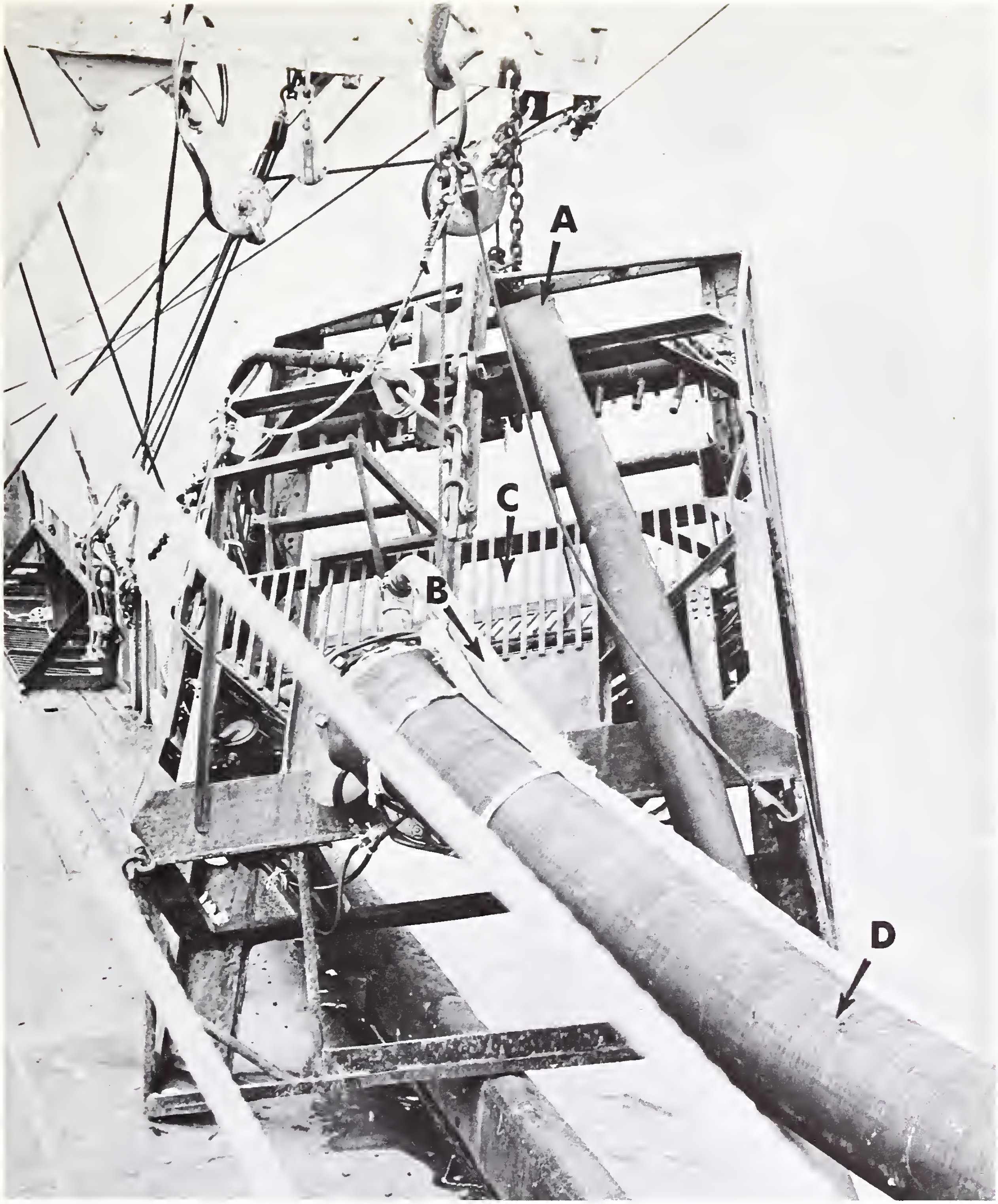

Figure 10.—Constant delivery pump system dredge aboard the *Gail Borden*. A — Clam jetting water supply hose. B — Compressed air hose. Air is supplied through this hose to the uptake unit where it mixes with the water in the hose, generating the upward movement of water within the hose. C — Receiver. Material jetted out of bottom and picked up by the dredge knife passes into this area and then into the uptake of the discharge hose. D — Transporting hose for carrying dredge material from receiver to separator.

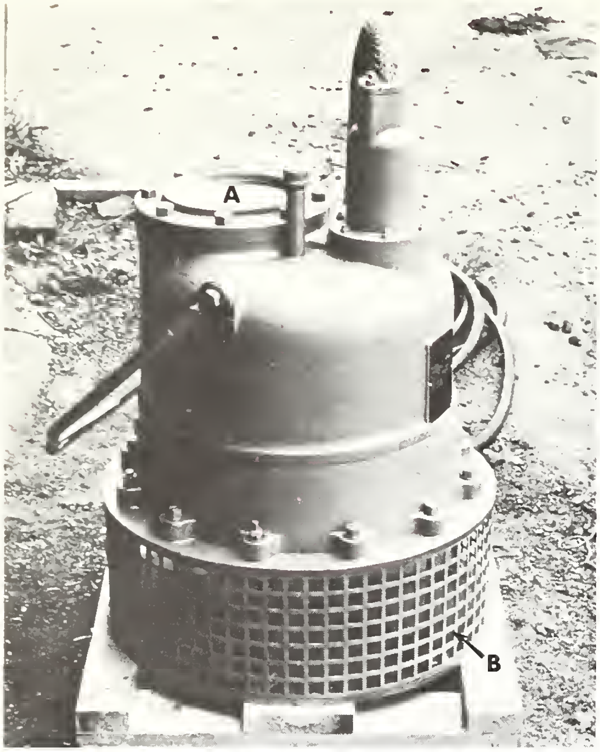

Figure 11.—Electrical submersible pump used for supplying water to dredge jets. A — Submersible pump discharge opening, 8-inch inside diam. B — Strainer surrounding pump, mesh size approximately 1-inch^2. Any object passing through this strainer will pass through pump.

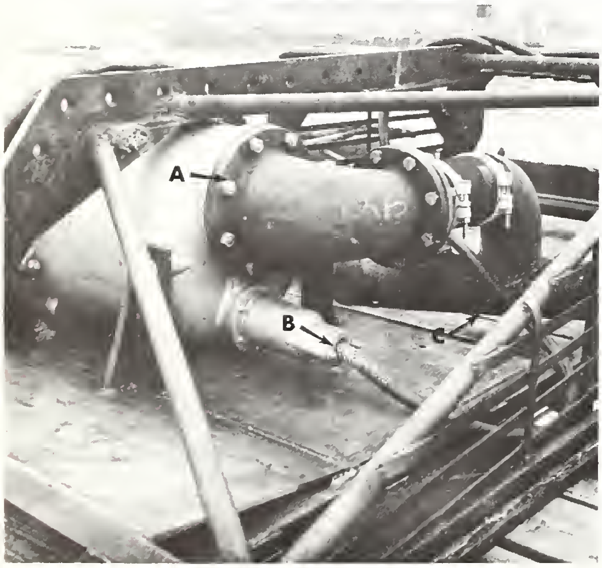

Figure 12.—Electrical submersible pump shown as mounted to 48-inch clam dredge. A — 8-inch discharge, connected to header. B — Watertight electrical junction. C — Header.

of this system is that it does away with handling the heavy hose required for the older pumping system while requiring less work to gear up.

Another recent innovation in clam gear is the adaptation of the stern trawler type vessel to clam dredging. This is accomplished by modifying the handling gear so that the dredge can be hauled in over the stern of the vessel (Figs. 13 and 14). This method of handling the dredge, along with some constant delivery system, may prove to be the most efficient method of harvesting the sea clam in the future.

VESSELS

Small dories and skiffs were first used by hand rakers and tongers to collect surf clams from the shallow waters along the coast. As mechanical methods for harvesting were developed during the 1920's, other types of boats were utilized to handle the new type of equipment. Party boats, skiffs, and conventional small draggers became the backbone of the commercial fleet. After widespread use of the hydraulic jet dredge became established, larger size vessels were needed. To meet the demand, regular fishing vessels were converted in order to accommodate this newer and more efficient method of dredging. Previously, these larger boats were generally used as shrimp boats (Fig. 15), oyster boats, fish draggers, sardine boats, and conventional military boats. The range of size for these boats is from 31 to 136 ft in length and from 14 to 160 gross tons. Most vessels are powered by diesel engines and are operated, when dredging, by two- or three-man crews, depending upon the size of the vessel.

SUMMARY

The development of surf clam harvesting gear is traced from early times to the present.

During this period of time, very little development work was accomplished prior to World War II. After this, rather rapid strides were made in development work by the surf clam industry and in the past several years by the Federal Government in cooperation with the surf clam industry.

The hydraulic jet dredge became the main piece of surf clam harvesting gear in use today.

Many modifications have been made or incorporated into this piece of gear since its inception. Today, the hydraulic jet dredge is being successfully operated from stern trawler type of boats.

This gear has been adapted for use on many different sizes and types of vessels, most of which have been converted from some other type of fishery.

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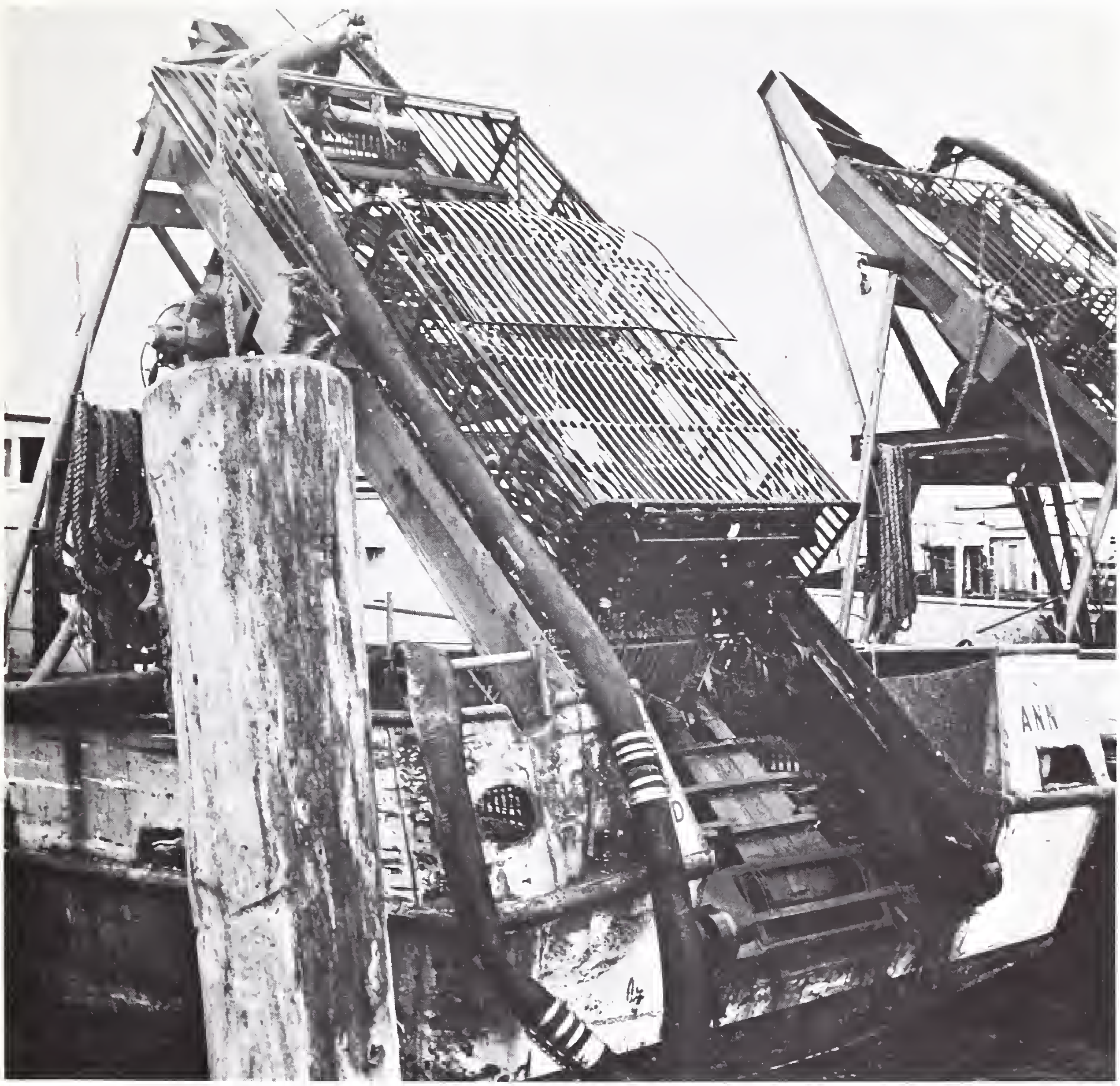

Figure 13.—Clamming vessel showing adaptation of gear to take dredge in over the stern while steaming.

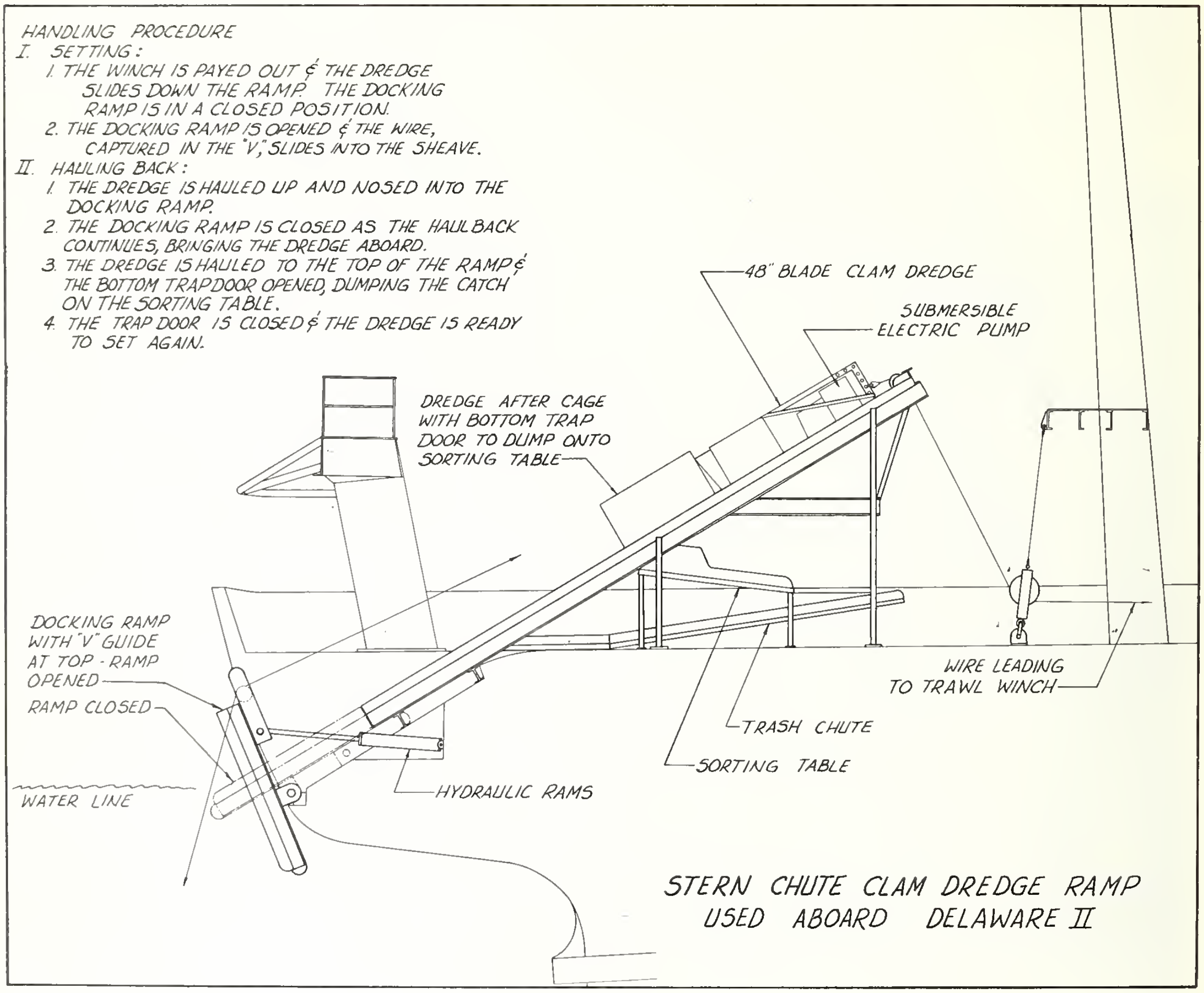

Figure 14.—Stern chute clam dredge ramp used aboard *Delaware II.*

Figure 15.—A converted shrimp boat. One of the several different vessel types which were converted for surf clam dredging.

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